

I claim:

1. An earth boring bit, comprising:

a body having at least one bit leg with a bearing pin depending therefrom;

a cone that is rotatably mounted on the bearing pin;

a seal cavity between the bearing pin and the cone;

a seal within the seal cavity in engagement with the bearing pin and the cone; and

the seal cavity having a volume that differs when measured at one circumferential point than other circumferential points.

2. The bit according to claim 1, wherein the volume of the seal cavity measured at any selected point around the circumference of the bearing pin changes at least once per revolution of the cone.

3. The bit according to claim 1, wherein a radial width of the seal cavity measured at any selected point around the circumference of the bearing pin changes at least once per revolution of the cone.

4. The bit according to claim 1, wherein the seal cavity has a mouth that is circular and has an axis that is offset from the axis of the bearing pin.

5. The bit according to claim 1, wherein a radial width of the seal cavity increases gradually from a minimum width point to a maximum width point 180 degrees from the minimum width point.

6. The bit according to claim 1, wherein an annular clearance is located between the seal cavity and an outer diameter of the seal, the annular clearance varying in radial width around the outer diameter of the seal.

7. The bit according to claim 1, wherein the seal comprises:

a metal seal ring;

an elastomeric energizer ring that in stationary contact with the bearing pin and urging the metal seal ring into contact with a seal face that rotates with the cone; and wherein

an annular space is located between an outer diameter of the metal seal ring and the seal cavity, the annular space having a radial width that varies around the outer diameter of the metal seal ring.

8. The bit according to claim 1, wherein the seal comprises:

a metal seal ring;

an elastomeric energizer ring that in stationary contact with the bearing pin and urging the metal seal ring into contact with a seal face that rotates with the cone; and wherein

the seal cavity has a greater inner diameter than an outer diameter of the metal seal ring and an axis offset from an axis of the metal seal ring.

9. The bit according to claim 1, wherein the seal comprises an elastomeric ring, and wherein the seal cavity has a groove that is located outward of the ring, the groove being spaced

radially from a seal boss formed on the bit leg, the groove being eccentric relative to an axis of the bearing pin.

10. The bit according to claim 1, wherein the bit leg has an annular machined surface located in a plane perpendicular to an axis of the bearing pin, and the cone has a backface spaced by a gap from the machined surface, the gap forming a part of the seal cavity; and wherein a plurality of vanes are formed on the backface of the cone.

11. An earth boring bit, comprising:

- a body having at least one bit leg with a bearing pin depending therefrom;
- a cone having a cavity for rotatably mounting the cone on the bearing pin;
- an entrance portion of the cavity extending around an outer diameter portion of the bearing pin, defining an annular seal cavity that has a radial width that varies so that as the cone rotates, the width of the seal cavity at any point along the outer diameter portion of the bearing pin changes at least once per revolution of the cone; and
- a seal in the seal cavity for sealing between the cone and the bearing pin

12. The bit according to claim 11, wherein the radial width of the annular clearance increases gradually from a minimum point to a maximum point 180 degrees from the minimum point.

13. The bit according to claim 11, wherein the entrance portion of the cavity is circular and has an axis that is offset from an axis of rotation of the cone.

14. The bit according to claim 11, wherein the width of the seal cavity changes once per revolution at any point along the outer diameter portion of the bearing pin.

15. The bit according to claim 11, wherein the seal comprises:

a metal seal ring; and

an elastomeric energizer ring that is in stationary contact with the bearing pin and urges the metal seal ring into contact with a seal face that rotates with the cone.

16. The bit according to claim 11, wherein:

the seal comprises an elastomeric ring;

the outer diameter portion of the bearing pin comprises a seal boss located outward from the ring; and

an eccentric groove is formed at the entrance portion of the cavity.

17. An earth boring bit, comprising:

a body having at least one bit leg with a bearing pin depending downward and inward therefrom;

a cone having a cavity that concentrically receives the bearing pin for rotation about an axis of the bearing pin, the cavity having a seal face located therein and a mouth at an entrance portion of the cavity;

a seal assembly in stationary engagement with the bearing pin and sliding engagement with the seal face in the cavity of the cone; and

the mouth of the cavity being circular about an axis that is offset from the axis of the bearing pin.

18. The bit according to claim 17, wherein the mouth of the cavity is spaced radially from the seal assembly.

19. The bit according to claim 17, wherein the seal assembly comprises:

a metal seal ring; and

an elastomeric energizer ring that is in stationary contact with the bearing pin and urges the metal seal ring into contact the seal face; and wherein

the mouth is radially spaced from an outer diameter of the metal seal ring by an annular clearance.

20. An earth boring bit, comprising:

a body having at least one bit leg with a bearing pin depending therefrom;

a cone that is rotatably mounted on the bearing pin, the cone having a backface;

and

a plurality of vanes formed on the backface.

21. The bit according to claim 20, further comprising:

a machined surface extending around the bearing pin at a junction of the bearing pin with the bit leg; and wherein

the vanes are spaced from the machined surface by a gap.